

Image-Based techniques for the virtualization of Egyptian contexts

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Abstract – In this paper we illustrate the use of cognitive metaphors for the transmission of historical and cultural contents as an indispensable condition in the process of museum communication. For this we used the 3D computer graphics animation to introduce the subjects dealt with in the exhibition spaces dedicated to Queen Nefertari, the chapel of Maya, the tomb of Kha, the house of the Golden Bracelet and the house of Octavius Quartio. In these filmed segments, passive viewing is offset by an emotional approach that engages visitors in an information path where, despite the inactive mode of fruition, they are in some way participants, because they are emotionally involved. The film itself is conceived as a showcase of changeable, heterogeneous digital content, capable to offer a concise, preparatory overview of the finds present in the museum spaces.

I. INTRODUCTION

This paper illustrates the activities realized for two important events organized by the Egyptian Museum of Turin: the inauguration of the new museum (2015) and the temporary exhibition “Il Nilo a Pompei - Visioni d’Egitto nel mondo romano” (2016). The goal and at the same time the challenge was to use easy and immediate forms of communication to disseminate contents of high scientific value sometimes not immediately understandable. To achieve this, it was decided to use passive cognitive forms that were not intrusive in the museum environment. Computer Graphics has been used to create five movies without a narrative voice, with brief textual information in Italian and in English, to highlight the message entrusted to the sequence of images¹. Animation in CG allows to represent spaces with unusual patterns: in section, in orthogonal view or with unreal framing. The result is an extremely addictive form of communication based, at the same time, on a rigorous scientific information developed starting from the analytical study of archaeological data. The bibliographic and archive research, led by the Egyptian Museum of Turin, and the study and survey of all the exhibits in the museum halls, has allowed to elaborate historical, artistic and architectural considerations able to present valid

reconstructive proposals, supported by archaeological data and technical solutions. Specifically, we used digital animation to introduce the knowledge of Queen Nefertari, the Maya chapel and the tomb of Kha in the specific exhibitions. Movies documentaries support the thematic route of the rooms offering a virtual tour to the visitors in the places where the goods displayed were discovered. The same approach has been used for the virtual reconstruction of two Pompeian contexts: the house of the Golden Bracelet and the house of Octavius Quartio.

II. THE TOMB OF KHA

In the Egyptian Museum of Turin, the exhibition hall dedicated to the architect Kha and his wife Merit, accommodates all the findings of an inviolated tomb discovered in 1919 by the well-known archaeologist E. Schiaparelli².

An unexpected discovery, reached *in extremis* after many failed attempts. It offers the opportunity to admire many objects, largely related to everyday life, under their artistic profile. Indeed, all the objects are shown as individual pieces of the museum, out of their original context without any communicative power, and it was a serious gap.



Fig. 1: The chapel and the tomb of Kha: section.

The movie fills this gap, virtually exploring the various stages of the discovery, giving a complete insight into the site. Starting from the chapel dedicated to Kha, that Schiaparelli considered the first sign of the presence of a tomb, after a long corridor barred by a series of three walls, it is possible to reach the funeral chamber.

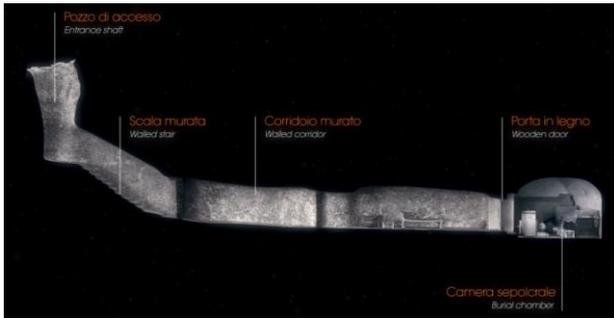


Fig. 2: The tomb of Kha: section.

To emphasize the moment of the discovery, the scene that was represented with photos taken when the last door was opened, have been animated. In particular, the photographic plans have been broken down and animated with camera mapping techniques to provide the sensation of entering and living the environment really unveiled. Each reconstruction is based on a long and detailed study of bibliographic sources, on the analysis of the reliefs made in the early twentieth century and on the observation of photographs taken at the time of discovery. Archaeological data was the basis for the entire narrative system, important for a faithful three-dimensional reproduction of Deir el-Medina's landscaping context and the architectural and structural distribution of the tomb. All this gives the visitor the opportunity to achieve more information and at the same time to take part to discovery thanks to the use of roscopic techniques, which can increase the emotional impact of vintage photos. The use of Image-Based³ techniques, absolutely necessary to recreate the perfect digital copies of the finds faithful in shape and color, contributed to increasing the emotional perception of the movie.



Fig. 3: 3D reconstruction of the finds in the tomb.

Digital and perfect copies offers a cognitive combination between what is really shown in the museum and what is present in movie, where the findings, also visible from other points of view, appear in their true essence and use.



Fig. 4: 3D reconstruction of the sarcophagus of Merit.



Fig. 5: 3D reconstruction of the sarcophagus of Kha and "the book of the dead" .

A significant example is offered by the sarcophagi. In the room they appear dissociated but originally they were one inside the other to preserve the mummy and objects that were supposed to accompany the deceased during journey in the afterlife.

In the movie, Image-Based models illustrate and describe an important archaeological data, not immediately understandable, showing the importance that ancient Egyptians attributed to the deceased. A crown of flowers and a long papyrus, "the book of the dead" had been posed on the first sarcophagus, inside which Kha's body was present. This was protected by two other larger wooden sarcophagi. Even Merit's mummy, originally enriched by a beautiful mask, had been enclosed within two sarcophagi. The use of cognitive metaphors makes the visit of the hall a unique experience rich interesting contents (www.youtube.com/watch?v=reKqzgyZU).

III. THE CHAPEL OF MAIA

In 1905 Schiaparelli discovered also the funerary chapel of Maia, a famous painter of the necropolis of Deir el-Medina during the XVIII dynasty. All tempera paintings that decorated the environment were detached and transferred to Italy to be reassembled in the Turin museum where they are still nowadays visible.

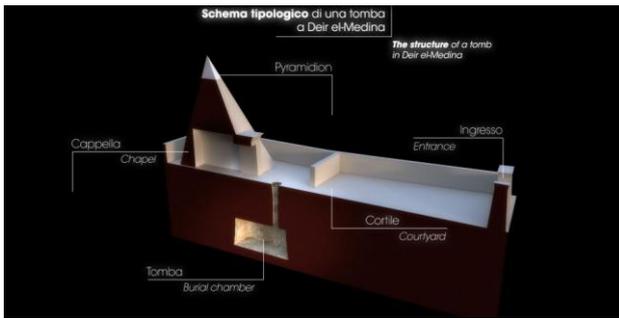


Fig. 6: Typical scheme of a tomb in Deir el-Medina.

However, the small size of the chapel (185x145x225 cm) together with the fact that it is not accessible, allow the observation of the paints only from a single point of view. In the movie realized thanks to the use of computer graphics and relief Image-Based techniques, we give the chance to explore the chapel inside, to open and section it, offering a privileged observation of the paintings. The proposed video integrates the actual visit with a virtual path from the necropolis of Deir el-Medina, leading visitors to discover the funerary chapel, in its typological organization and knowledge of funerary rituals illustrated in the wall decorations. Starting from comparative studies carried out on other chapels of the same necropolis, it was possible to integrate the gaps with outlines able to offer an exhaustive vision.



Fig. 7: 3D reconstruction of the sarcophagus of Maia and digital restoration of paintings.

The overall view describes the contents of the registers in the order of reading and allows one to observe the ritual procession horizontally, in accordance with its natural development. Increased zoom over the figures allows one to appreciate the features and stylistic details, with additions of reconstructive drawings that complete, as far as possible, the description of the ritual.

IV. THE TOMB OF QUEEN NEFERTARI

One of the exhibition halls of the Egyptian Museum is dedicated to Queen Nefertari. Here there is the wooden model of her tomb built by Ernesto Schiaparelli (1905). This is a perfect reproduction of the original model (scale 1:10).



Fig. 8: Funerary room and sarcophagus of Nefertari.

It was built to give the opportunity to understand the architectural development of the tomb and the magnificence of the wall paintings, replicated with special care. The result, with great astonishment, allows to understand the architectural model, to visit all the environments and to admire all the wall paintings. You can start a virtual tour in ancient Egypt and test the emotion that archaeologist Schiaparelli experienced in 1904 when, at the head of the Italian archaeological expedition, he first visited one of the best preserved tomb of the ancient civilization.

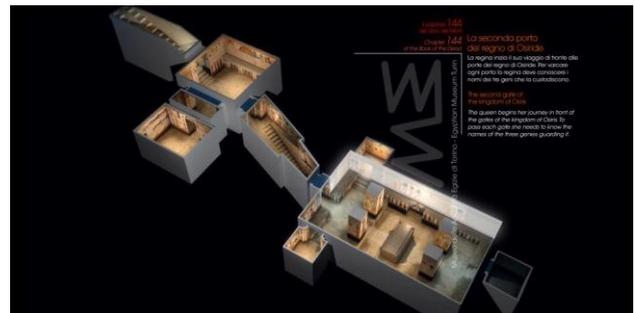


Fig. 9: 3D reconstruction of the tomb of Queen Nefertari.

The documentary movie produced by IBAM ITLab is aimed at replicating the communicative message desired by Schiaparelli, offering a virtual tour, according to new perspectives, enriched by short and concise captions to facilitate the reading of the paintings and illustrating the "post mortem" journey which the Queen Nefertari to its divination, better known as "solarization".



Fig. 10: 3D reconstruction of the tomb of Queen Nefertari.

The virtual tour begins and ends with the digital model of the tomb. Techniques of close range photogrammetry have allowed the 3D survey starting

from the acquisition of different high-resolution photographic data set with a full frame camera. All photos have been processed with Agisoft PhotoScan in order to obtain a digital model with texture; the accuracy was verified with the data coming from the direct survey. Special attention was paid to the photographic restitution of the paintings respecting the original colors and size, creating orthorectified images on the detected metric data before mapping them over the 3D model. Image-Based technologies have also been used to reproduce the remaining part of the sarcophagus, whose pink granite coverage, although fragmentary, is still exposed in the Egyptian Museum: it was the fulcrum around which the funerary complex dedicated to the greatest queen of Egypt was arranged (www.youtube.com/watch?v=meRVQ0y6pC8).

V. THE HOUSE OF OCTAVIUS QUARTIO

For the temporary exhibition "Visioni d'Egitto", a movie on the garden of the house of Pompeius Quartio in Pompeii has been realized too. Its planimetric plant is characterized by a long central canal that crosses it longitudinally and is adorned with a lot of various water games. It remembers the Nile River and the Egyptian culture. This is also confirmed by the presence of a series of small ornamental statues in Egyptian style.



Fig. 11: 3D reconstruction of the private garden.

Thanks to Computer Graphics, the garden has been virtually reconstructed in 3D not only from an architectural point of view, but also in terms of its original arboreal appearance. Careful consultation of excavation data and subsequent analyses of vegetal presences have highlighted the presence, in the past, of specific species at precise points of the garden. For a correct interpretation and reconstruction of the space, techniques of digital restoration have been used to improve the iconographic reading of wall painting, which is now partially destroyed. Image-Based and 3D digital sculpting techniques enabled the 3D reproduction of all the sculptures found in this house, but currently preserved in the repository of the Superintendency for the Archaeological Heritage of Pompeii. The problem of showing, in the movie, all those documented findings,

lost because of the bombing of 1943, has been addressed to remaining firmly anchored to archaeological data. In Particular, hand-made modeling techniques have been used to reproduce all the objects visible in old photos and supported by historical descriptions. (Ibis, Bes, bearded mask).



Fig. 12: 3D reproduction of the sculptures.

The video, even if lacking a narrative voice, but enriched with short captions, offers the visitor the opportunity to understand the context in which the artworks were placed, involving it by recalling the lost atmosphere of one of the most famous private garden of Pompeii (www.youtube.com/watch?v=zm1qtY17JpA).



Fig. 13: 3D reproduction of the Egyptian style sculptures.

VI. THE HOUSE OF GOLDEN BRACELET

The House of the golden bracelet has been named after the discovery of an extraordinary six hundred weight gold bracelet. The building presents an innovative and complex architectural distribution with terraced layouts on three levels in a panoramic position on the western slopes on the hill of Pompeii. On the lower floor of the house there was a large private garden with a *triclinium*, a *nymphaeum* and a semicircular central fountain surmounted by a pergola. All the space was enriched by beautiful wall painting and mosaics, removed in the seventies, featuring Egyptian themes. In order to allow visitors to understand the original context, starting from survey and using Image-Based technologies, it was possible to present a virtual reconstruction of the garden with its original decoration.



Fig. 14: 3D reproduction of the stunning panorama visible from the triclinium of the Golden Bracelet House.

Even in this case, starting from the current state of the structures, the video reveal the lost atmosphere of a lovely place. Short captions focus on the presence of those icons of Egyptian art, that intrigued by the Romans, and emphasize the relationship between painted plants and those present before the eruption of 79 B.C. the final result is a commemoration of a ancient place with a strong emotional power, able to transmit to the visitor an immediate cognition of what is present in the exhibition, and what appeared in the past in the eyes of the ancient Romans.

CONCLUSION

The synthesis imposed by the short duration of the movie made it possible to match all available information with a self explanatory approach, which allows the visitor to understand the peculiarities of the archaeological goods displayed in the exhibition in a general view that repeats colors, sounds and suggestions of the environments destroyed two thousand years ago. In digital animation, passive viewing is compensated by an emotional approach that lead the visitors in an formative path where, despite the inactive mode of vision, they become participants, because they are emotionally involved.

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Fig. 15: 3D reproduction: triclinium, nymphaeum, wall paintings and mosaics.



Fig. 14: 3D reproduction: detail of the triclinium.